
Coastal and marine biodiversity conservation in India

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India's coastline holds many biological treasures. Handsome mangrove forests of Sundarbans, the world's largest congregations of nesting turtles in Odisha, beautiful seagrass beds in Palk Bay, enigmatic sea cows in the Gulf of Mannar, majestic yet gentle whale sharks in the Gulf of Kachchh and some of the world's most beautiful and striking coral reefs are examples of the some of the biological treasures of India's coastal and marine biodiversity. Besides being store houses of biological diversity, coastal regions are also home to a large human population. However, due to industrialisation and urbanization, these ecosystems are under pressure. Global climate change is likely to put them under additional stress. Sustainable development of coastal and marine ecosystems may reduce the pressure on them and also help in preserving biological diversity.

Indian coastal ecosystems comprising mudflats, sandy and rocky beaches, estuaries, creeks, mangroves, coral reefs, marshes, lagoon and seagrass beds extend to approximately 42,808 km². They are known for their high biological productivity, which provide a wide range of habitat for many aquatic flora and fauna. The Indian coasts support about 30% of the total 1.2 billion human population. Several major cities, including some of the largest and most densely populated urban mega-agglomerations (eg. Mumbai, Kolkata, Chennai, Kochi and Visakhapatnam) are located on the coast. Activities such as fishing, ports, agriculture, oil and mineral exploitation contribute significantly to India's economy.

Major anthropogenic direct drivers of ecosystem degradation and destruction include habitat conversion to other forms of land use, overexploitation of species and associated destructive harvesting practices, spread of invasive alien species, and the impacts of pollution from agricultural, domestic and industrial effluents. In this paper, the major issues related to coastal and marine biodiversity conservation and measures taken to address them have been highlighted.

Corals: The extent of coral cover in Indian seas is 2375 km². Reefs provide economic security to the communities who live alongside them. Traditional fishers and people whose livelihood is dependent on the reef perceive reefs as a source of food and revenue. They also perceive the reef as a defense against erosion caused by ocean waves. Diverse human activities such as runoff and sedimentation from developmental activities, eutrophication from sewage and agriculture, physical impact of maritime activities, dredging, destructive fishing practices, pollution from industrial sources and oil refineries have emerged as threats to the coral reefs. Among natural threats, storms, waves and particularly cyclones are major stresses on corals. Another major challenge for sustainability of corals reefs is warming and acidification of seawater. As the reefs were common property, often conflicts in resource use were witnessed. Later, protection of all species of corals under Wildlife (Protection) Act 1972 and declaration of Marine Protected Areas and National Parks effectively reduced exploitation of corals. After the implementation of protection measures, the corals reefs are stated to be recovering from their status in the 1960s.

Mangroves: As per the State of Forest Report 2011, published by Forest Survey of India, the mangrove cover in the country stands at 4662.56 km². Compared with 2009 assessment, there has been a net increase of 23.34 km² in the mangrove cover of the country. This can be attributed to increased plantations in coastal States and regeneration of natural mangrove areas in the country. Mangrove ecosystems provide a life support system and income for people who use various Non Timber Forest Produces from them. In general the mangroves are resistant to environmental perturbations and stresses. However, mangrove species are sensitive to excessive siltation or sedimentation, stagnation, surface water impoundment and major oil spills. Salinities high enough to kill mangroves result from reductions in freshwater inflow and alterations in flushing patterns from dams, dredging and bulk heading. Seawalls, bunds and other coastal structures often restrict tidal flow, which is detrimental to the mangroves. In India, mangrove plantation programmes have been taken up, which are helpful in expanding the mangrove cover. The large expanse of inter-tidal mudflats (23,621 km²) may provide scope of adjustment and adaptation in some areas, mostly in the semi-arid region.

Seagrass: Seagrass ecosystem provides a sheltered, nutrient rich habitat for diverse flora and fauna. The habitat complexity within seagrass beds enhances the diversity and abundance of animals. There are several reports of reduction in the spread of seagrass meadows along the Indian coasts. Several causes have been attributed for the deterioration of seagrass beds. Eutrophication, siltation, trawling, coastal engineering constructions and removal for commercial purposes are the major threats for seagrass beds. Seagrass occurs in shallow water bodies below the low tide line and since water bodies are not brought under regulations, the CRZ notification is ineffective to protect sea grass beds.

Seaweeds: Along the Indian coast, about 770 species of seaweeds are distributed, of this 184 species are green, 166 are brown and 420 are red algae. The estimated standing stock (wet weight) is about 541,340 t. Seaweeds are excellent breeding grounds for marine organisms, and are important as food for humans, feed for animals, fertilizer for plants, and for pharmaceutical purposes. Collection of wild seaweeds by the coastal population has reduced the seaweed cover over the years. Farming of seaweeds has become popular and is livelihood for coastal population in the Palk Bay and Gulf of Mannar (southeast coast of India).

Whaleshark: Until 2000, the whaleshark was exploited by unregulated and unsustainable fisheries to meet international trade demands for shark fins, liver oil, skin and meat. In July 2001, the whale shark was included in Schedule I of Indian Wildlife (Protection) Act, 1972, thus giving whaleshark protection and making it the first marine fish to be listed in the aforesaid Act. The whaleshark campaign has spread awareness on the species and the protected status in Gujarat (northwest coast of India). It helped convert the fishermen into protectors of the fish and brought about a change in the perception and attitude of local people.

Marine turtles: Of the seven species of turtles that occur in the world five breed along the Indian coasts. Among these, mass nesting of olive ridley occurs along Odisha coast (east coast of India) every year. Government of India is taking strict actions to protect the marine turtles under the Indian Wildlife (Protection) Act (1972), and in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna & Flora (CITES). Fishing is prohibited during the mass nesting period of the olive ridley along the Odisha coast. Beach hatcheries are also in place in a few locations.

Marine mammals: All species of marine mammals along the Indian coasts are protected under the Indian (Wildlife) Protection Act (1972). However, they continue to be affected by incidental capture in fishing operations. The population of dugong has reduced to low levels over the years.

Sea cucumbers: As sea cucumbers were collected in large numbers and exported, the government prohibited the activity under Schedule I of the Wild Life (Protection) Act 1972. Central Marine Fisheries Research Institute has developed breeding techniques for sea cucumbers, enhancing the potential for sea ranching the seed for stock improvement as well as for establishing commercial hatcheries.

Marine Protected Areas (MPAs): India has 33 coastal and marine protected areas and 3 marine bioreserves, with a total area of 5,319 km². The protected areas cover less than 1.3% of the Indian coast.

Fishing: While India is moving from open access fishery towards regulated fishery, several issues remain to be addressed. Overfishing and habitat degradation are emerging concerns associated with fisheries. These factors jointly affect fish stock biomass as well as biodiversity of ecosystems. Fishing and pollution are perceived as two major threats to coastal and marine biodiversity in the country. Marine Fishing Regulation Acts (MFRA) and Comprehensive Fishing Policy are two major instruments aimed at regulating fishing operations to sustain the fisheries as well as biodiversity. Cap on the number of mechanized boats, seasonal closure of fishing, spatial fishing restrictions, mesh size regulation, use of bycatch reduction devices (BRD) and turtle excluder device (TED) are followed, but implementation of these measures remains as a challenge.

Coastal management policies: Under Environment Protection Act (1986), the Government of India has notified the Coastal Regulation Zone (CRZ) Notification, 2011. Accordingly there are four coastal management zones: (i) CRZ 1 consists of ecologically sensitive areas (mangroves, coral and coral reef associated biodiversity, sand dunes, mudflats, national parks, marine parks, sanctuaries, reserve forests, wildlife habitats, biosphere reserves, salt marshes, turtle nesting grounds, horseshoe crab habitats, seagrass beds and nesting grounds of birds), and the geomorphological features that play a primary role in maintaining the integrity of the coast. No new construction shall be permitted in CRZ I in the ecologically sensitive areas. (ii) CRZ II consists of areas which are developed up to or close to the shoreline and falling within government administrative limits. (iii) CRZ III consists of all other open areas including the coastal seas but excluding those areas classified as CRZ-I, CRZ-II and CRZ -IV. (iv) CRZ IV consists of islands of the Andaman and Nicobar and Lakshadweep.

Present day plans targeting marine resources continue to be oriented towards their optimal utilization. The concerns raised by fishermen organizations and environmental groups regarding development need to be examined and participatory decision making strengthened. Coastal areas are contested spaces and strong policies are required to safeguard the interests of the millions of stakeholders who occupy these areas and dependent on the resources. The need for ecosystem approach to management of fisheries and biodiversity is being increasingly realized and adopted.